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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/912,632	07/26/2001	Tetsuya Kawagishi	212052US-2	7747
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OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314				
			EXAMINER JAWORSKI, FRANCIS J	
			ART UNIT 3737	PAPER NUMBER 16

DATE MAILED: 03/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/912,632

Applicant(s)

KAWAGISHI ET AL.

Examiner

Jaworski Francis J.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 and 22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 and 22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 12.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 20 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically, as this claim is understood (meaning line 16 "restrictive" to be read -- respective --), it pertains to a plural pulse inversion sequence set where transmission parameters between sets are caused to vary for the purpose of broadening the bandwidth of harmonic component capture. This apparently is a claiming of embodiment nine, specification pages 32 line 13 – 33 line 20 which does not state how the transmission characteristic is varied towards the desirable bandwidth broadening effect.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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Claim 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 20 recites the limitation 'the restrictive transmission characteristics' in line 16. There is insufficient antecedent basis for this limitation in the claim.

Additionally, the language "to mutually synthesize, every type of transmission' is vague in meaning. Do applicants intend --time of transmission—or -- for every such transmission varying characteristic set --?

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(It is noted that the term 'synthesis' may have a narrow context in this art in contradistinction for example to 'compounding' in terms of where the assemblage takes place in relation to envelope detection, see Ustuner et al (US6432054) col. 1 lines 14 – 24. The Examiner is treating the term as akin to 'combining', i.e. an ascribed breadth not so narrowly construed absent any concomitant claiming of carrier RF or envelope-detected signal stages. For example all of the 'synthesis/compounding/combining'

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structure of Ustuner et al col. 1 lines 30-40 and col. 6 lines 52-58 were weighed vis-à-vis th applicants' claimed 'synthesis means/unit'.

(Parenthesized claim numbers pertain to the particular claim(s) to which the rejection sentence applies.)

Claims 1, 8-9,13, 19, 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Robinson et al (US6315723). Robinson et al teaches structure and method for an ultrasound diagnostic scanning system including two or more transmissions along each scanline and at least encompassing overlapping depth zones (Fig. 2 and col. 3 lines 29-65) or full scanlines (Fig. 7). In either case the receiver means includes filter means 110, 40 respectively which filters include for each scanline a different FIR filter weighting and multiplier - (114, 116), (115, 117), or (32,42),(34,44), or (36,46) in the full line, 3-pulse case. Synthesis elements are at 119, 48 respectively with producing means 22-28 and display 30 in either case. (Claims 1,13,22). Synthesis units 119, 48 are summation nodes which add the weighted scanlines to form the synthesized reception signal (Claim 8). The result is a change in focus between beams as a zone (Fig. 4) or continuum (Fig. 5). Additionally the equalization weighting is tantamount to an amplitude or receiver adjustment for depth attenuation, see Col. 3 lines 53-64. (Claims 9,19).

Claims 1, 8-9, 13, 19, 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Hossack et al (US5957852). Hossack et al suggests structure and method in Fig. 10 and attendant discussion that multiple transmit pulses from 12 for the

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same transmission characteristic may be transmitted, whereupon the received scanline at 14 may be filtered for fundamental or harmonic information in respective channel filters 174, 176 with synthesis at 182 for display onto 30. Hossack et al later effectively state that since harmonic imaging is more tissue-type sensitive, an extended focus is preferred for effective harmonic utilization and may be had by either a line focus or by sequential transmissions focused at differing depths along the scanline, see col. 11 lines 31-33. In this latter case the transmission characteristic of focal depth **differs** for the successive transmissions as does receiver gain and amplitude of the received pulse, see also col. 11 lines 14-18. (Claims 1, 8-9, 13, 19 and 22).

Claims 1-2, 8-9, 13-14, 19 and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Seyed-Bolorforosh et al (US5891038, of record with IDS Paper No. 12). Seyed-Bolorforosh et al teaches structure and method for an ultrasonic diagnostic apparatus for performing two or more pulse firings along a scan line via 10 with differing narrowband excitation waveforms for each transmission, with reception and beamforming at 38 along with filter processing wherein the narrowband filters differ for each channel, see cols. 8-9 bridging and col. 11 lines 27-31, synthesizing means 54A, 54B and producing means 42-46 for display on 32, 30. (Claims 1, 13, 22). The synthesis includes a summation on 54A,B (Claim 8). Differently centered frequencies are used for each firing per col. 5 lines 25 – 40. (Claims 2, 9, 19).

Claims 1, 3 –6, 8-10, 12-13, 15-20, 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Chiao et al (US5980459).

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Chiao et al is directed to pulse inversion imaging with changeable transmit phases as stated col. 4 lines 26 – 34, slow-time filtering synthesis per respective pulse firing occurs as shown in fig. 3 and col. 6 line 36 – col. 7 line 8 to individually weight and summation-produce harmonic and subharmonic tailored filter responses shown in Figs. 4-11. (Claims 1,8,, 19, 22). Figs. 4-11 show variously narrow transmitted bandwidths (solid lines) (claims 3,,9, 15) and includes production of filtered harmonics and/or subharmonics (dashed or dotted) (Claims 4, 16) including a broadband harmonic Fig. 7, (dashed.) (Claims 5, 12, 17, 20) and partial overlapping (claim 10). Subharmonics (dotted) are produced during contrast harmonic or tissue harmonic imaging, see col. 3 lines 42-45. (Claims 6, 18).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-4, 12, 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seyed-Bolorforosh et al, since the col. 11 line 46-49 suggestion to use puretones for superior isolation of harmonics appears to be a suggestion in consideration of overall context to use multiple transmits of narrowband excitation. (Claims 3,15). The equalization filters would then synthesize the(contrast agent) harmonics per this

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passage. (Claims 4, 16). Unlike the claim 5 or claim 17 case, claim 12 does not provide an internal reference for 'broader-bandwidth' ('broader than what') and therefore is groupable under this rejection as simply referring to some degree of bandwidth.

Claims 3-7, 10-12, 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seyed-Bolorforosh et al as applied to claim 22 above, and further in view of Ustuner et al (US6432054). Ustuner et al proclaims relationship to the former, see col. 1 lines 13-23 but adapts the narrowband signals transmitted so that the harmonic may be received with a fundamental transmitted, see col. 2 lines 31 – 54 in order to extend the resolution image to harmonic tissue or contrast agent imaging. (Claims 3, 15). Both the transmitted beams may result in harmonics, see col. 2 lines 45-48. (claim 4). In such circumstance, the broad bandwidth may be reconstructed, see col. 6 lines 13 – 23. (Claims 5,12, 17). The subharmonic may be so generated and in conjunction with use of a contrast agent., see col. 2 lines 45-49. (Claim 6). Depth-dependent filtering in such a combination would be practiced since Seyed-Bolorforosh et al teach in col. 8 lines 21-32 that such is necessary for compensating for frequency-dependent attenuation effects which are depth-dependent. In the case of retrieving the fundamental as per Ustuner et al col. 2 lines 31 – 54, this depth filtering compensation would necessarily preserve the fundamental when the fundamental is being received. (Claim 7). Independent frequency retrieval would inherently occur during narrowband filtering tailored to the dual frequency transmission in Seyed-Bolorforosh et al as amended by the fundamental-harmonic usage for such dual frequencies in Ustuner et al

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during frequency compensation enactment and along with change in pulse number as called for in col. 6 lines 47-52.. (Claims 10,11). Sampling is mandatory in order to implement the discrete filter multiplication and apply weighting coefficients. (claim 16). Non-linearity without contrast agent in Ustuner et al would be tantamount to tissue non-linearities as per col. 2 lines 48-49 (Claim 18).

Claim 20 is rejected under 35 U.S.C. 102(e) / 103(a) as being unpatentable over any of Averkiou et al (US6186950), Haider et al (US6063033), Ermert et al (US6155981), Gee et al (US6358210), Averkiou (US6319203), Hwang et al (US6228031 and 6193662) in addition to the application of Chiao et al (US5980459) *supra*.

[Note that Claim 20 does not internally reference 'broaden a bandwidth'. It merely states a relevance to not – relative to – a fundamental. Therefore the Examiner is purveying in the multiple rejections the position that ' There is uncertainty as to what the transmit-parameter-differing pulse inversion sets are (112 1st *supra*), there is uncertainty as to what the claim means in terms of synthesis from such sets (112 2d *supra*), and there is breadth of scope in that bandwidth broadening without a point of reference is non-limiting. It is appropriate to lodge all relevant art rejections involving enhanced pulse inversion harmonic imaging which use multiple transmit-variant sets under anticipatory/obviousness arguments in order to identify patentable exclusivity.']

Averkiou et al '950 - transmit pulses are variant for pulse intervals, see col. 4 lines 5-7, col. 6 lines 48-41. cascaded partial sum synthesis 116 of Fig.4 or summation weighted filtering 140 of true four-pulse embodiment Fig. 8b constitute 'synthesizing

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unit' for display purposes. Enhanced fundamental suppression as well as suppression of motion contaminants per col 10 lines 5 – 10 result in better harmonic isolation and are therefore argued to meet or render obvious the 'broadening' limitation.

Haider et al – transmit pulses are variant for drive pulse amplitude between pulse inversion sets, see col. 2 lines 23-33. Synthesis at 52, 54 or 60 of Fig. 2. System favors isolation of desired higher order harmonic by weighting choices. Anticipates or renders obvious the broadening of capture bandwidth above noise levels.

Ermert et al - Transmit pulses are non-equidistant in phase between inversion sets, see col. 4 lines 17 – 24, col. 8. Non-coherent I.e. demodulated summation synthesis leads to improvement of SNR for the harmonic. Anticipates or renders obvious the broadening of capture bandwidth above noise.

Gee et al – Transmit pulses are real and imaginary solutions to complex ensonification signal matrix within the pulse sets. The four pulse case is set by equation col. 4 lines 27 – 41. element 24 or step 60 represent synthesis step. Reduction in harmonic –fundamental interference and isolation of harmonic component such as the positive harmonic either anticipates or renders obvious the broadening of bandwidth of the harmonic component.

Averkiou – '203 - Transmit pulses vary in both amplitude and phase. Quadrature filtering is practiced on respective lines 126, 136 with summation at 124, 134. More than a two-pulse set may be used with this regime, see col. 6 lines 37-42. Results in passband enhancement of harmonic on reception. Tantamount to anticipation or rendering obvious of bandwidth broadening for same.

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The following art is cited as cumulative to art applied:

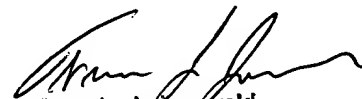
Rhyne et al (US5961463) - Transmit coding for phase modulation of transmit pulses. Decorrelation (matched) filtering on the reception channels. Synthesis via pulse inversion summation. Improved linear cancellation/non-linear effects (harmonic or subharmonic) emphasis.

Brock-Fisher (US6213946) - Orthogonal coding of successive pulses with matched filtering and coherent combination of scanlines to produce speckle-reduced display.

Any inquiry concerning this communication should be directed to Jaworski Francis J. at telephone number 703-308-3061.

FJJ:fjj

2-21-04


Francis J. Jaworski
Primary Examiner